INTERCONNECTIONS OF THE DS14500A ICU TO THE MOTOROLA MOUNTING SYSTEM BOARDS

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The Motorola ICU demonstration system can be interconnected to the I/O module mounting boards (MS4, MS8, MS16, MS24) to develop an industrial control unit capable of interfacing with the real world. This application note explains how to perform the interconnections to develop this system.

The ICU demonstration unit consists of two sections; the DS14500B control unit and the DS14500C I/O simulator. It is possible to remove the I/O simulator and utilize the DS14500B as a programmable control system by interconnecting it to an MS board. This approach will require the use of buffers external to the ICU to drive the output modules in the mounting system. On the other hand, if both the DS14500B and DS14500C are used, the buffers in the latter can be connected directly to the output modules. Both approaches will be described below.

METHOD I:
INTERCONNECTIONS OF THE DS14500B TO AN MS BOARD:

On the DS14500B unit, the 40-pin connector (AMP #1-87577-7) contains all the input/output terminals required to interface it to an MS board. (see Figure 1). Pins 1 and 2 are connected to the supply line of the ICU. If we apply 5 Volts to the MS board, these pins can be used to supply 5 Volts to the ICU and vice-versa. Pins 3 through 18 are the output lines of the ICU. These lines come from a data latch (MC14099B). Due to the low current sink capability of this latch, it is necessary to add buffers (MC14049)* to the output lines of the ICUs that are used to drive OAC5 or ODC5 modules. This buffer stage can obtain its supply from either pin 1 or 2 of the ICU connector. Pins 19 through 22 are in-

puts to the program counter, and they allow the most significant bits (MSB) of the program counter to be set externally of the ICU. These pins would normally be left open; however, if they are used, the load program counter switch should be depressed in order to enter the MSB of the counter. Pins 23 and 24 are ground, and can be used to provide the logic ground for the MS board and the MC14049 buffers. Pin 25 is the reset pin, which will halt a program and set the program counter to zero when a logic 1 is applied. Pins 26 through 40 are the input pins of the ICU, and are connected to an MC14512 data selector. These pins can be connected directly to the outputs of the IDC5 or IAC5 modules in the MS board.

Figure 1 shows an interconnection schematic for an MS16 board with I/O modules in positions 1, 4, 11, 14, and 15 of the MS16. These locations are by no means standard, the only requirements are that the output modules (OAC5, ODC5, OAC5-A) be driven by buffers connected to the output pins (3 through 18) and the input modules (IAC5, IDC5, IAC5-A) drive the reset or input pins of the ICU (25 through 40). On the interconnection shown, the output of the IDC5 module on the position #1 and IAC5 module on position #14 are respectively the input to input #1 and #12 of the ICU. The ODC5 and OAC5 modules are being driven by output 0 and output 12 of the ICU.

*A SN74L505 or similar buffer can also be used.

(3) MC14049 Buffers

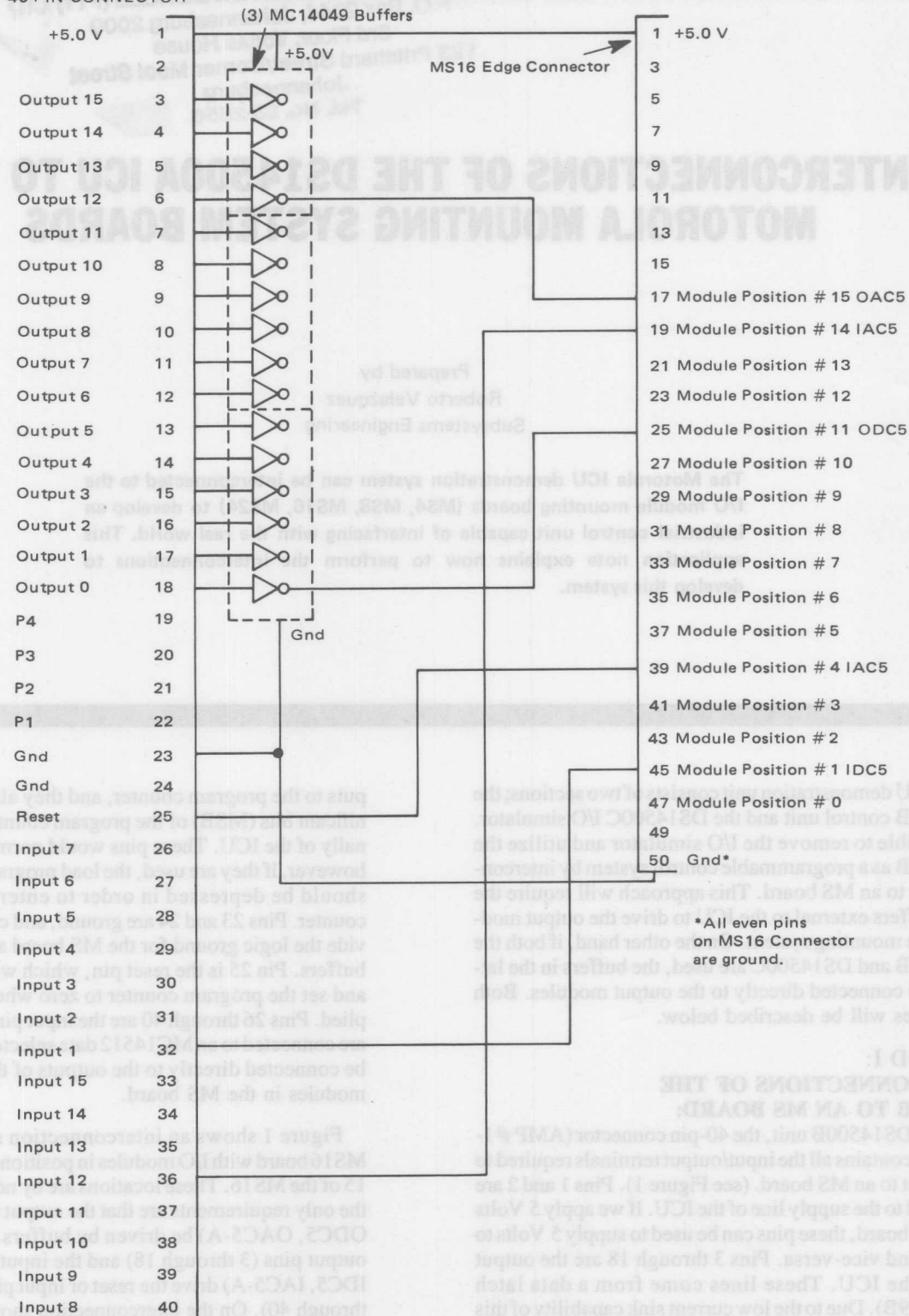+5.0 V

MS16 Edge Connector

DS14500B 40-PIN CONNECTOR		MS16 Edge Connector	
+5.0 V	1	1	+5.0 V
	2	3	
Output 15	3	5	
Output 14	4	7	
Output 13	5	9	
Output 12	6	11	
Output 11	7	13	
Output 10	8	15	
Output 9	9	17	Module Position # 15 OAC5
Output 8	10	19	Module Position # 14 IAC5
Output 7	11	21	Module Position # 13
Output 6	12	23	Module Position # 12
Output 5	13	25	Module Position # 11 ODC5
Output 4	14	27	Module Position # 10
Output 3	15	29	Module Position # 9
Output 2	16	31	Module Position # 8
Output 1	17	33	Module Position # 7
Output 0	18	35	Module Position # 6
P4	19	37	Module Position # 5
P3	20	39	Module Position # 4 IAC5
P2	21	41	Module Position # 3
P1	22	43	Module Position # 2
Gnd	23	45	Module Position # 1 IDC5
Gnd	24	47	Module Position # 0
Reset	25	49	
Input 7	26	50	Gnd*
Input 6	27		
Input 5	28		
Input 4	29		
Input 3	30		
Input 2	31		
Input 1	32		
Input 15	33		
Input 14	34		
Input 13	35		
Input 12	36		
Input 11	37		
Input 10	38		
Input 9	39		
Input 8	40		

Gnd

*All even pins
on MS16 Connector
are ground.

FIGURE 1 — Interconnection Schematic for MS16

puts to the program counter, and they allow the most sig-
nificant transitions of the program counter to be set exter-
nally of the ICU. These pins would normally be left open;
however, if they are used, the load to program counter switch
should be depressed in order to enter the MSB of the
counter. Pins 23 and 24 are ground, and can be used to pro-
vide the logic ground for the MSB of the ICU and the MC14049
buffers. Pin 25 is the reset pin, which will halt a program
and set the program counter to zero when a logic 1 is ap-
plied. Pins 26 through 40 are the input pins of the ICU and
are connected to the MC14512 selector. These pins can
be connected directly to the outputs of the IDC5 or IAC5
modules in the MS board.

Figure 1 shows an interconnection schematic for an
MS16 board with I/O modules in positions 1, 4, 11, 14 and
15 of the MS16. The interconnection by no means stringent;
the only requirement is that the four output modules (OAC5,
ODC5, OAC5, ODC5) are driven by the lines connected to the
output pins (3 through 18) and the input modules (IAC5,
IDC5, IAC5-A) drive the reset or input pins of the ICU (23
through 40). On the interconnection shown, the output of
the IDC5 module on the position #1 and IAC5 module on
position #14 are respectively the input to input # 1 and # 12
of the ICU. The ODC5 and OAC5 modules are being driv-
en by output 0 and output 12 of the ICU.

The ICU demonstration system consists of two sections, the
DS14500B control unit and the DS14ACDC ICU simulator.
It is possible to remove the I/O simulator and utilize the
DS14500B as a programmable controller/system by interfac-
ing it to an MS board. This approach will require the
use of buffers external to drive the output mod-
ules in the mounting system. On the other hand, if both the
DS14500B and DS14ACDC are used, the buffers in the lat-
ter can be connected directly to the output modules. Both
approaches will be described below.

METHOD I:
INTERCONNECTIONS OF THE
DS14500B TO AN MS BOARD:

On the DS14500B unit, the 40-pin connector (AMP #-
87377-7) contains all the input/output terminals required to
interface it to an MS board. (see Figure 1). Pins 1 and 2 are
connected to the supply line of the ICU. If we apply 5 Volts
to the MS board, these pins can be used to supply 5 Volts to
the ICU and vice-versa. Pins 3 through 18 are the output
lines of the ICU. These lines come from a data latch
(MC14099). Due to the low current sink capability of this
latch, it is necessary to add buffers (MC14049)* to the out-
put lines of the ICUs that are used to drive OAC5 or ODC5
modules. This buffer stage can obtain its supply from either
pin 1 or 2 of the ICU connector. Pins 19 through 22 are in-

*A MC14050 or similar buffer can also be used.

METHOD II:
INTERCONNECTIONS OF THE DS14500B AND C TO THE MS BOARD

If the DS14500B is used to drive the DS14500C, the latter can be interconnected directly to the MS board. (see Figure 2). The LED's O_1 - O_{15} on the DS14500C are driven by U_1, U_2, U_3 which are MC14049 buffers. By removing the LED's and connecting wires from the holes where the LED cathode was (top hole) to the output modules, it is possible to drive these modules in the MS board. The module connected to O_1 is now driven by output #1 of the ICU, the module connected to O_2 is driven by output #2 and so forth until O_{15}.

In order to input a signal from an MS board module to the ICU, the switches labeled I_1 to I_{15} are replaced by wires coming from the input modules of the MS board. When the switches are removed from the DS14500C board, three holes will be seen under each switch; the upper hole is unconnected, the middle hole is a ground connection, and the lower hole is the signal path into the ICU. This lower hole is the one that must be connected to the input module signal. If any input or output is not to be used, the LED and switches can be left on the board. The 5 Volt and ground for the MS board can be obtained from the 5 Volt and ground post of the DS14500C.

A disadvantage in using method II is that the halt/reset function and inputs to the program counter are not easily accessible. If they are required, wires must be soldered to the pins in the connector itself. The most significant bits (MSB) of the counter are pins 19 – 22, while pin 25 is the Halt/Reset pin.
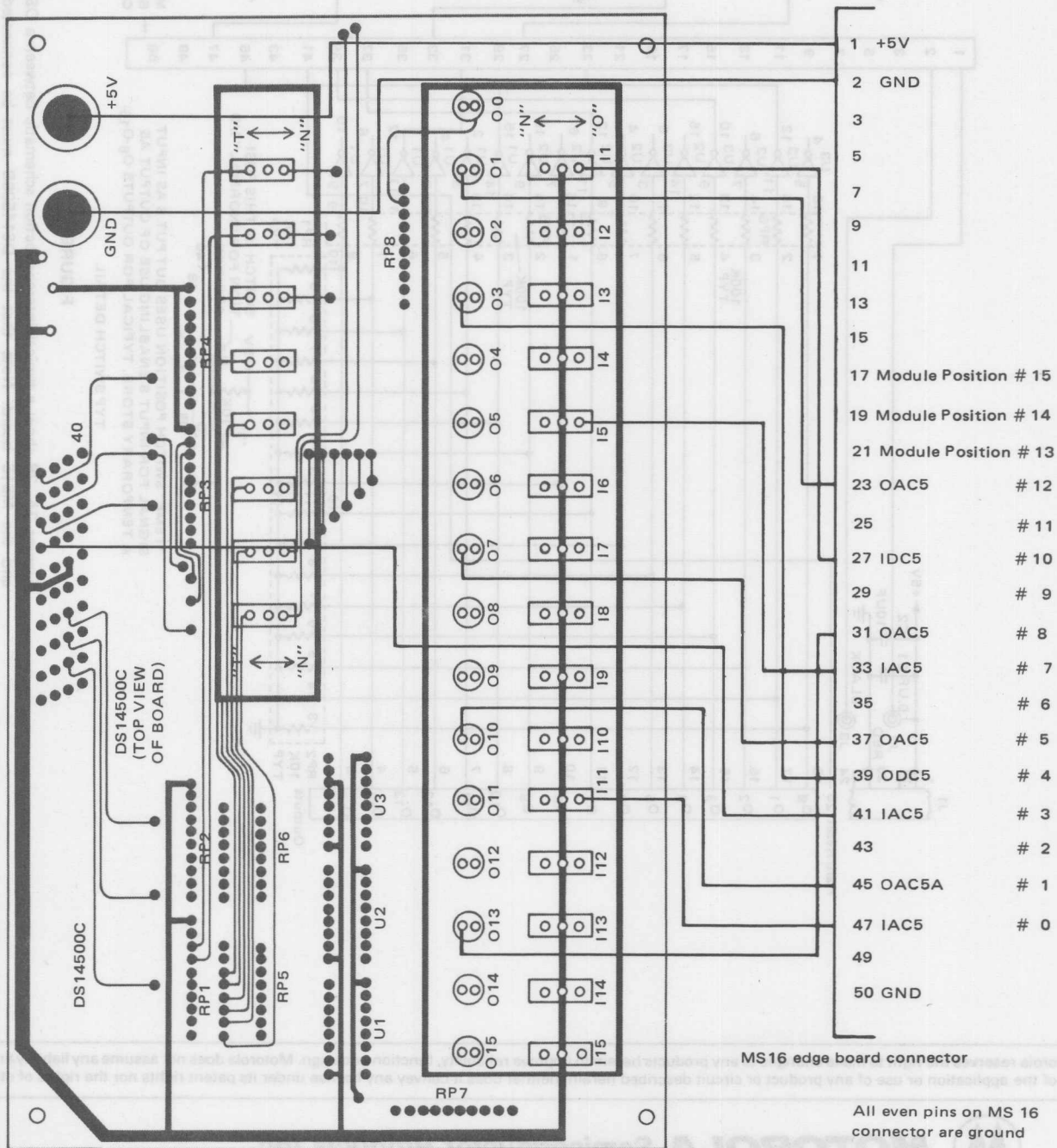

FIGURE 2A

MOTOROLA Semiconductor Products Inc.

J1

J2 RED   0.UF C1   C2   +5V

J3   BLACK   10UF

Halt/Reset 25

Outputs
O_0 18 O_1 17 O_2 16 O_3 15 O_4 14 O_5 13 O_6 12 O_7 11 O_8 10 O_9 9 O_{10} 8 O_{11} 7 O_{12} 6 O_{13} 5 O_{14} 4 O_{15} 3

RP6 100K TYP

RP5 100K TYP

U3   U3   U3   U3   U2   U2   U2   U2   U2   U2   U1   U1   U1   U1   U1   U1

RP2 10K TYP   RP1 10K TYP

MS16 Board Edge Connector

+5V   RP3 10K TYP

10 9 8 7 6 5 4

32 I_1 31 I_2 30 I_3 29 I_4 28 I_5 27 I_6 26 I_7

SEE SWITCH DETAIL. SWITCH SHOWN IN "NORMAL" POSITION.

N 40 I_8
O_8 N T 39 I_9
O_9 N T 38 I_{10}
O_{10} N T 37 I_{11}
O_{11} N T 36 I_{12}
O_{12} N T 35 I_{13}
O_{13} N T 34 I_{14}
O_{14} N 33 I_{15}
O_{15} T

Inputs

+5V   5 6 7 8 9 10 2 3
1

IDENTIFICATION NOTCH OR MARK ON PIN 1 END, TYP

DS14500C, I/O Simulator

"I" 10K   +5V
SWITCH IN THIS POSI-
TION FOR "NORMAL" I/O
N   SERVICE
"O"   40
10   08   T   18

"TEMP" SWITCH POSITION USES OUTPUT 8 AS INPUT
SIGNAL FOR INPUT 8 ENABLING USE OF OUTPUT AS
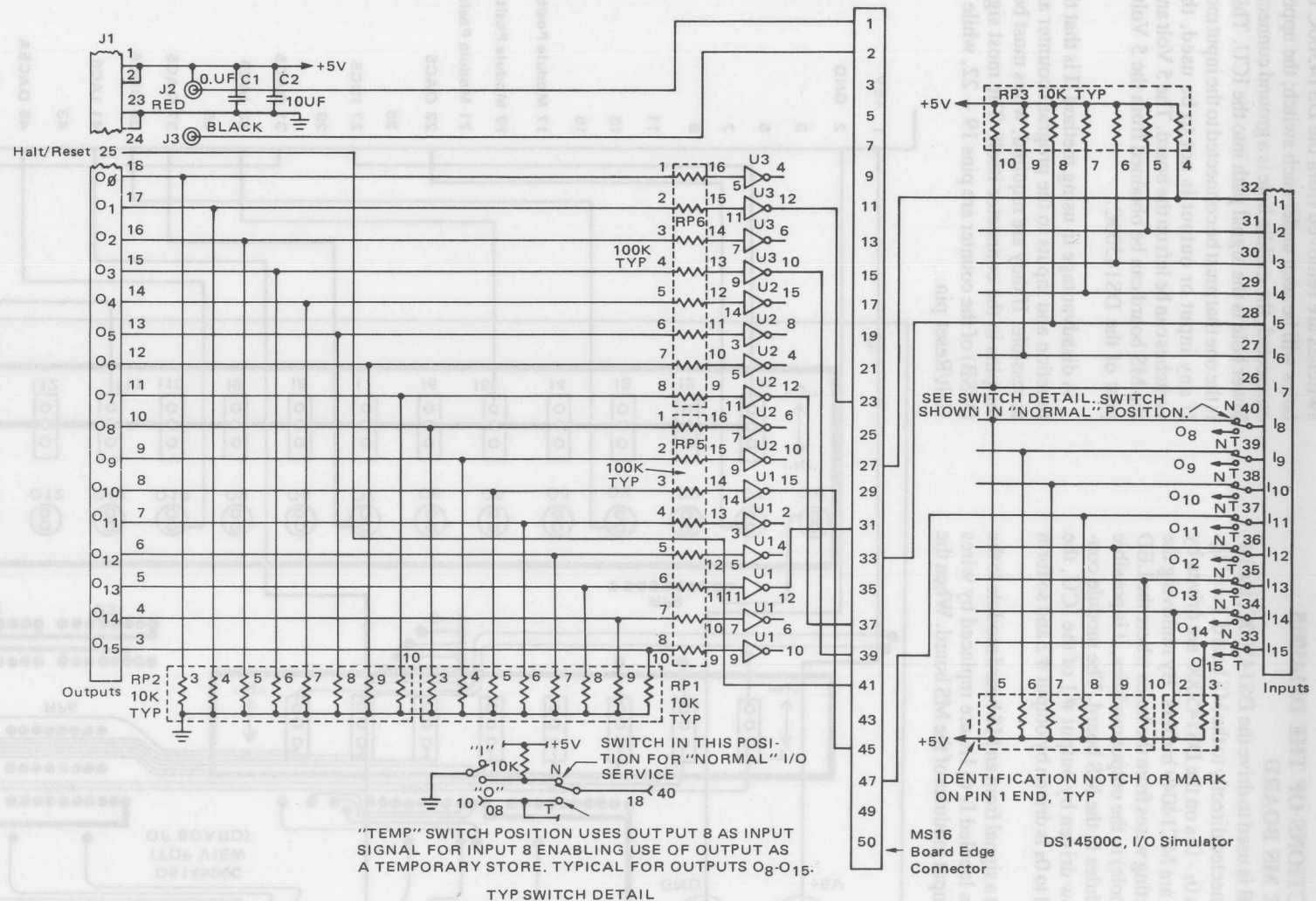A TEMPORARY STORE. TYPICAL FOR OUTPUTS O_8-O_{15}.

TYP SWITCH DETAIL

FIGURE 2B

Figures 2A, 2B show a typical interconnection schematic between a DS14500C and the MS16 board. Note that the DS14500B must be connected to the DS14500C unit during operation, since the DS14500B is the control unit.